THE TELEGRAPHIC JOURNAL.

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THE INTERNATIONAL TELEGRAPHIC CONFERENCE OF ST. PETERSBURG.

THE telegraphic relations of the United Kingdom with the Continent are carried on under the provisions of a Convention concluded originally at Paris in 1865 between many of the principal States of Europe; adhered to afterwards by other States, by British India and Persia, and subsequently revised in 1868 at Vienna, and in 1870-71 at Rome. After the transfer of the telegraphs to the Government in 1870, the British Postal Telegraph Department decided to adhere to the International Convention, and was represented at Rome by Mr. Alan Chambre—who also, jointly with Mr. H. C. Fischer, represented the Department recently at St. Petersburg.

One of the chief objects of the International Telegraphic Conference of St. Petersburg was to consider a new codification of the Convention and Detailed Regulations which, by a decision arrived at at Rome, had been undertaken by the Bureau International at Berne. This work—admirably performed by the latter—resulted in a reduction of the Convention from 65 articles to 21, and this was achieved by transferring to the detailed regulations many provisions that previously formed articles of the Convention. The latter being considered to settle fixed principles and to be made once for all and unchangeable at the periodical Conferences, the wisdom of placing all questions and matters which can more properly be settled by regulations, will be apparent. The Detailed Regulations can, of course, be altered as experience and circumstances may, from time to time, show to be necessary or desirable.

To meet the views of several Delegates, the new Convention provides that periodical Conferences shall in future not be held successively in the capital of each of the contracting States as formerly arranged, but that each Conference shall settle the place and date for the next reunion.

The Conference held its sittings at the Ministry of the Interior. The countries represented at the opening sitting—which took place on the 1st June—were Great Britain, Austria, Hungary, Belgium, Denmark, Egypt, France, Germany, Greece, Italy, Japan, Norway, The Netherlands, Portugal, Russia, Sweden, Switzerland, and Turkey; and, subsequently, the Persian Government named a representative, and the Chargé d'Affaires of the United States attended the debates on behalf of his Government but took no part in the discussions, as the United States have not joined the Convention. The leading Cable Companies were also represented. His Excellency the Minister of the Interior, M. de Timatcheff, opened the Conference in a speech of welcome, and sketched out the programme of the labors about to be undertaken, with a view to building upon the experience of the past a more perfect and complete Convention regulating the International Code of Telegraphy. After a suitable reply made by the President of the last preceding Conference—that of Rome—the President-Elect of the St. Petersburg Conference, the Director-General of Telegraphs de Lüders, addressed the Delegates, and proceeded to name the staff for the Bureau of the Presidency.

The second meeting—and the first for practical business—was held on the following day, and afterwards the Conference met three days a week; leaving the other three working days free for the Commissions. The latter—No. 1 for questions relating to tariffs, and No. 2 for questions relating to rules and regulations—were very fully occupied in sifting the various propositions before their discussion in general Conference, and in this manner many propositions were withdrawn, modified, or amalgamated with rival proposals, and a large amount of valuable time was saved. This mode of procedure was much facilitated by the arrangement adopted under which both Commissions sat at varying hours, and the members of each were thus enabled to attend the sittings of the other Commission; but as Sub-Commissions had, later on, to be appointed, and the same principle was adopted, the effect was, practically, to make the work on these off days press very heavily upon the delegates. Any other arrangement would, however, have prolonged the Conference much beyond the time actually occupied—nearly eight weeks.

The New Convention remains to be ratified by the respective governments after consideration and signature by their respective Diplomatic Agents at St. Petersburg. The Delegates, on this occasion, signed the Detailed Regulations, but not the Convention as remodelled.

The printed *Procès-Verbaux* of the Conference, to a perusal of which we are indebted for our information, enable us to give the following outline of the leading questions discussed.

To suit the national prejudice and habits it was agreed, at the request of Great Britain, that each State may limit the hours of service *on Sunday* at offices which are not open permanently day and night.

The system in vogue in this country of allowing an abbreviated or code address for telegrams, upon the payment by the addressee of an annual fee, will be adopted, and the signature of the sender will no longer be compulsory.

All indications, such as "reply paid," &c., must in future be written by the sender in French; in the language of the country in which the telegram is to be delivered; or they may be given by letters adopted for the International Service, such as "R.P." &c.

The address, except the name, must also be given in French, or the language of the country to which the telegram is addressed.

The length of a telegram, except in the case of extra European traffic, will be maintained at twenty words, increasing by series of ten words as heretofore. A vigorous effort was made by Great Britain to obtain that a first decision of the Conference to adopt a gradation by series of *five* words should be maintained, but we regret to say without success. For Extra-European telegrams, the rate will be by word throughout the whole distance, but it will remain for the Administrations interested to declare for a simple word as in the case of Anglo-American messages, or for a word tariff with a minimum of ten words.

The maximum length of a word will be limited to fifteen characters of the Morse Alphabet, and

any word used in a telegram containing more than this number will be charged extra in proportion to the excess. In the case of Extra-European messages the same regulations will be made to apply, but with a limitation of *ten* characters.

In messages containing secret language (so-called), groups of ciphers or letters will be counted and charged for, group by group, in the same way as ordinary numbers written in cipher; that is to say, at the rate of one word for every five ciphers, any fraction over being counted as one word.

Three new classes of messages were introduced, and gave rise to prolonged and serious debates. Great Britain in common with Austro-Hungary in one case, with Italy in the second, and with Switzerland in the third case, declared that she was not prepared, for the present at all events, to adopt either one or the other, and in consequence of the formal opposition of several States in regard to these three measures, it was finally carried that they should be adopted only between such States as declared that they were willing to do so. These new messages consist of:—

First.— "Urgent" telegrams which are to have precedence over ordinary telegrams deposited at the same time, or earlier, and still awaiting their turn for transmission, and such telegrams are to be charged three times the ordinary rate.

Secondly.—The "*Telegramme recommandée*" with repetition, a receipt, and an acknowledgment, upon payment of a triple rate by the sender. In case of serious error or delay, or total loss of the message, the sender may claim not only to have refunded the rate paid, but is to receive a fixed indemnity of fifty francs."

Thirdly.—The "*Avis Telegraphique.*" This is declared not to be a telegram properly so called, but to give the facility to those persons who desire to send short messages at a cheaper rate the means of doing so, provided they are willing to forego all the advantages offered or to be claimed in the case of ordinary messages at the higher rate. They are to be limited to ten words, and must not contain secret or code language; numbers will only be accepted if written in full letters; they will be charged at the rate of three-fifths of the ordinary telegram, and will be delivered open (without envelope) to the addressee. No claims of any kind in respect of these messages will be entertained, and they will be transmitted between the offices admitting them without any of the formula observed in the case of ordinary messages.

A great many other changes and additions were made to existing regulations, either in elucidation or to remedy difficulties and objections which experience had shown to exist; but they are not of a nature to interest the general public.

One other measure of interest, however, was the passing of a resolution to adopt generally, wherever any of the States found it desirable to do so, the arrangement made between the British and French Administrations with the proprietors of the *Times* to allocate to the use of the latter, at night, for a yearly payment, in one sum, a wire between London and Paris, under which arrangement we are enabled—at our breakfast table—to read a column or more of news from the "most fascinating capital in Europe" up to the latest possible date.

The next Conference is to be held at London in 1878; but the exact date will be fixed by the British Government. Mr. Chambre, in announcing to his colleagues that Great Britain accepted the choice of the Conference, assured them that they would be welcome. Let us hope that our Government will indeed, when the time comes, show themselves to be alive to the necessity of receiving the representatives of every State in Europe, and several *out* of it, in a fitting and cordial manner and, without attempting to rival or excel the efforts of our Foreign friends to entertain the Conference, that they will not allow red tape and prejudice to stand in the way of doing what we can to make the sojourn of our numerous guests profitable and agreeable to them.

ON THE TELEGRAPHIC PROBLEMS OF DOUBLE SENDING AND QUADRUPLEX TELEGRAPHY.

By G. K. WINTER,
Telegraph Engineer to the Madras Railway.

THE practical success which has attended the revival of duplex telegraphy has doubtless led many, besides myself, to enquire whether the difficulties in the way of the simultaneous transmission of two messages in the same direction over the same line were altogether insurmountable. A very little thought over the matter will show that the difficulties to be encountered in solving this problem are altogether of a different nature from those attending the question of duplex working, and, further, it is evident that if once these difficulties were overcome, the problem of quadruplex telegraphy would be solved by applying to our apparatus similar arrangements to those by which duplex telegraphy has already been rendered practical.

It is obvious that to send two messages at the same time in the same direction on the same wire between two stations, two keys are required, and it is also obvious that with two keys, each having independently two positions, there are four combinations, which of course should each produce a different effect upon the receiving instruments at the distant end. Thus, suppose we have two keys, which we will call A and B respectively, we shall have,

1st combination, both keys at rest.
2nd ,, A depressed, and B at rest.
3rd ,, B depressed, and A at rest.
4th ,, Both keys depressed.

There are two different ways of attacking the problem, namely:—

1st. To devise such an arrangement of the keys that each of the four combinations shall produce a different electrical effect on the line, and then to endeavour so to arrange the receiving instruments that these different electrical effects shall be rightly interpreted by them.

2nd. To endeavour so to arrange the receiving instruments that, with some four variations in the electrical state of the line, four combinations, analogous to those of the keys we have noticed above, may be produced; and then to devise some arrangement of the keys by which the desired electrical states of the line may be produced by their action.

I have only seen two systems described in any of

the works on electricity or telegraphy that I have read. One is given by Blavier, and the other by Sabine. In each of these it would appear that the inventors had set to work according to the first method, for in each the method of joining up the keys is practically the same, and intended to produce currents as follows:—

1st. Both keys at rest. No current.
2nd. A depressed, and B at rest, one unit of current.
3rd. B depressed, and A at rest, two units of current.
4th. Both keys depressed, three units of current.

All the currents being in the same direction.

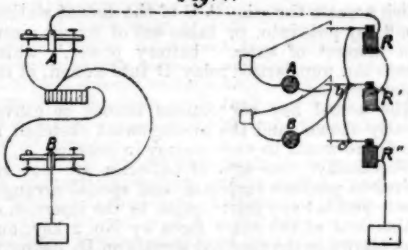
This is the most obvious arrangement of the keys, and it will be seen from the following descriptions of the methods, that in each of them the inventors have been successful in rightly interpreting the different signals sent; thus, supposing the local instruments at the receiving station to be Morse instruments, we find that—

1st. When no current arrives, both Morses are at rest.
2nd. When one unit of current arrives, Morse A is acted upon and Morse B is at rest.
3rd. When two units of current arrive, Morse B is acted on, and Morse A is at rest.
4th. When three units of current arrive, both Morses are acted on.

So that, at first sight the problem would appear to have been solved in each case; on examining the matter further, however, we shall find that false signals would be made during the changes from one combination to another, which, apart from another drawback, we shall notice, would suffice to render the methods useless.

The methods given by Blavier is as follows:—

Fig. 1.



R R^{I} R^{II} (Fig. 1) are three relays joined up one after another between the line and the earth at the receiving station.

Of these R is the most sensitive and will work with one unit of current.

R^{I} is rendered less sensitive by means of an opposing spring: it will not work with one unit of current, but it will with two.

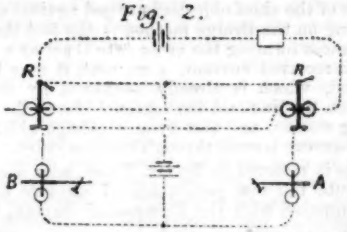
R^{II} is rendered still less sensitive by means of stronger opposing spring; it will not work with less than three units of current.

It will be seen that the Morse A is joined up in such a way that so long as the relay R^{I} is at rest, it will work whenever the tongue of relay R is acted upon by the current. So long, therefore, as the key A only is worked, and, consequently, only one unit of current sent into the line, the Morse A will indicate the signals given by the key A. When the key B is depressed, it is evident that two units of current are sent into the line, consequently, the current is strong enough to work both the relays R and R^{I}. The relay R^{I} in working, completes the circuit of Morse B, and at the same time breaks the circuit of Morse A; thus, so long as only the key B is worked, the Morse B will indicate the signals given by the key B. Now suppose we depress both keys, there will be three units of currents, and, consequently, the relay R^{II} will be worked as well as the others. It will be seen that when relay R^{II} is worked, the break in the circuit of Morse A, which is caused by the working of relay R^{I}, is made good, and thus both Morses will be worked. So far, all well; but now let the key B be raised, the current will be reduced to one unit, and, consequently, both the relays R^{I} and R^{II} will be drawn back. Of course the circuit of Morse B will be broken, but so also will, for an instant, that of Morse A; for it is evident that the tongue of relay R^{II} will have broken contact with C before the tongue of relay R^{I} can have made contact with B, and thus recompleted the circuit of Morse A. Thus, at this change, there will be a sudden interruption of the working of Morse A, not answering to any signal given by its key, and a confusion of signals must arise.

Added to this, however, the difficulty of keeping the three relays at proper states of sensitiveness would be almost insurmountable. The difficulty of the interruptions of the circuit in the intervals between the positions of rest and the depression of the keys could be overcome by known methods.

The system given by Sabine was invented by Stark, of Vienna, in 1855. The method of connecting the keys was somewhat different from that shown above, but the result was exactly the same, so we will only concern ourselves with the receiving apparatus. This is represented in Fig. 2.

Fig. 2.



In this arrangement only two relays of different degrees of sensitiveness are employed. Relay R is the most sensitive, and will work with with one unit of current; relay R^{I} is less sensitive, and will work with two units of current, but not with one. When relay R^{I} works, however, it not only completes the circuit of the Morse B, but also of another circuit, through an extra coil of the relay R, in such a direction as to oppose the action of the currents coming from the line, and thus render it less sensitive and only to be worked by three units of current in the line circuit.

According to the plan, whenever the key B is worked both relays will work for it is not until the relay R^{I} has made its contact that the sensitiveness of relay R will be reduced, consequently at every depression of the key B we shall have a momentary kick on the Morse A, not in accordance with any signal given by its key, and thus confusion of signals must result Again, although we have only two

relays to adjust as to sensitiveness, yet one of these has two states of sensitiveness, one of which, namely, that caused by the opposing action of the local current, would be even more troublesome than the adjustment of the third relay by means of a spring. Neither of these methods can therefore be said to offer any hope of practical success.

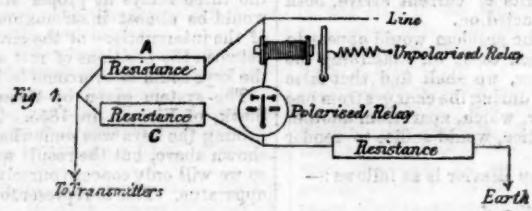
Having now examined the principles and learnt the defects of the old systems, I will next endeavour to explain as clearly as possible the principles of the system by which I have achieved a practical success, and the line of thought which led to its discovery.

(To be continued.)

QUADRUPLEX TELEGRAPHY.

By A. EDEN, Assoc. Soc. T. E.

THE *Telegraphic Journal* of the 1st ultimo contains a paper read before the meeting of the American Electrical Society at Chicago, U. S., by Mr. F. W. Jones, which describes Messrs. Prescott and Edison's "Quadruplex" as a "Wheatstone's Bridge," in which two relays are placed in the position of the Galvanometer, thus:—



One of the chief objections urged against duplex working on the Bridge method is the fact that the resistances forming the arms A to C act as a shunt for the received current, a current, it may be remarked, which is already weakened by division between the line and the artificial line at the originating station, and also by any leakage which may occur during transit through the line-wire.

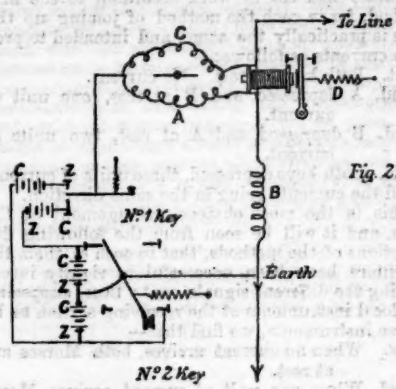
This is referred to by Mr. Jones, who seems to attribute the low percentage of effective current (as compared with the Differential duplex) to this cause.

It occurred to me, however, that if one of the receiving instruments could itself be made the arms of the "Bridge," and the other receiving instrument inserted in the Bridge wire, that one of the derivations from the effective received current would be avoided, and intead of losing the current passing by the arms A and C, it would be available for signalling purposes.

Putting this view of the question to a practical test, when I could spare time from official duties, I found that it answered admirably, but that some difficulty was experienced with the unpolarised receiving instrument.

This was eventually overcome, and one of the advantages of this mode of connection seems to be a practical exemption from the induced-current difficulties mentioned by Mr. Jones as being incidental to the American method.

The resistances A and C (Fig. 2) forming the arms of the bridge, are the two coils of, a differential polarised relay through which the outgoing currents pass in opposite directions, the current



passing by A, going through the resistance marked B, and that going *via* C passing out to the line.

No. 1 key is arranged to send reversed currents, which actuate the relay A C of the distant station. No. 2 key puts into, or takes out of circuit a certain amount of extra "battery power," which brings the unpolarised relay D into action, at the distant station.

The actual key connections cannot be conveniently shown, and the arrangement sketched in the figure would be very clumsy in practice.

Practically, two sets of batteries are not required to produce reversals, and special arrangements prevent any interruption by the insertion or withdrawal of the extra force by No. 2 key, any irregularity in the received signals on D, owing to the changes of polarity in the received current produced by the distant stations No. 1 key, or any alteration of the battery resistance when No. 2 key is closed or opened.

Subsequent experiments proved that the best method is to make A a resistance equal to the instrument coil in C, and put the other instrument coil behind the adjusting resistance B, and the point of junction between A and the Bridge wire.

LONDON FIRES—WATER SUPPLY.

NOT long since our contemporary the *Standard*, in a powerful leading article, directed attention to a communication addressed to it by the East London Waterworks Company with reference to the above important subject. From this communication it

appeared that a letter had been received by the company from the Metropolitan Board of Works, stating that the attention of the Fire Brigade Committee had been called by complaints and inquiries from local boards and others "to the delays "which, even with the best efforts on the part of "the water companies, occasionally occur in "obtaining a supply of water at fires." The committee were said to be "well aware that the only certain way of avoiding these delays, and of being always sure of an immediate supply of water available for extinguishing fires, was to have all the mains constantly charged at high pressure." But as this was not at the present moment, and probably would not for some time be obtainable, the committee were anxious to ascertain whether "some means might not be found by which the men of the Fire Brigade would be able, on arriving at a fire, to obtain immediately for themselves a supply of water without waiting for a turncock in the event of the latter not being at a fire so soon as themselves."

From the foregoing and from other portions of the correspondence between the Metropolitan Board of Works and the Waterworks Company, it would appear that a difficulty is at times felt in obtaining, in certain localities, a ready and efficient supply of water, to enable the London Fire Brigade to cope with that element which once destroyed, and may again prove disastrous to, our capital.

Many parts of London are already supplied with water under pressure night and day, Sundays and holidays; but many other portions—and doubtless these portions are those narrow, densely-populated thoroughfares in which fires are most difficult to deal with, and in which, where a fire once gets a hold from want of water or other causes, its ravages are terrible—are either entirely without a water supply, or have only a short "service." The Board of Works points out that although each fire-engine carries with it a complete set of turncock's tools, it is not unfrequently found of no avail, inasmuch as the firemen do not know what mains in the neighbourhood of the fire are charged with water at the time.

Will not the Postal Telegraph Department, or some energetic telegraph engineer, step forward, and, whilst relieving both the Board of Works and the Water Companies of their difficulty, contribute towards the greater security of life and property in the Metropolis, by suggesting the propriety of establishing electric communication between the district police or fire stations, and the officer whose duty it is to see to the turncocks of that locality?

Nothing could be easier than to establish some such simple means of communication as should obtain attention at any moment, night or day. Bells of almost any tone and power are now under the control of the telegraph engineer, whilst, if necessary, indicators carrying the name of the locality or street could at will, and at the same time as the bell is ringing, be brought up to an aperture; there would be thus not only an audible, but a visual signal to those in charge. Wherever it is usual for the turncock to be sought in the moment of need by the fireman, whether at an office, or at his residence, this bell indicator ought to be fixed; the wires from the different fire-engine stations in the section under his charge would concentrate upon that point, and on either one being used the "indicator" would show, independent of the bell, the locality where the man's services were required. By this means a certain, and in all probability a very great advantage in point of time would be gained, and we all know what this means in a question of fire.

With such means at our command—simple and uncostly—surely it is not expedient that valuable property, apart from the sad loss of life that too frequently accompanies it, should longer remain subject to the present uncertain method of obtaining the services of the all-important "turncock." Doubtless hydrants and mains constantly charged under pressure would, with certain regulations, render the most efficient aid; but as this is not yet, and cannot for some time be obtainable, if indeed it ever will be in certain localities, then let us by all means have the best substitute for it. As to the protest of the Waterworks Company—"That "it is not their duty to bear the expense incident "to maintaining the present slovenly and imper-"fect practice, and that they ought not to be "subjected to the aggravated waste which is "necessarily incident to it," we are only doing ourselves justice in pointing out that the course we suggest to the consideration of both bodies is one calculated to remove at once any source of waste, whilst the expense which will be incurred by adopting it is so trifling that the fire insurance offices themselves would doubtless gladly defray it, and save money by the transaction.

THE BRITISH ASSOCIATION.

THE great carnival of science, the meeting of the British Association, was opened at Bristol, on Wednesday, August 25th, by Sir John Hawkshaw, the President for the present year, delivering his inaugural address. As intimated by Professor Tyndal, the retiring President, in a few brief words of introduction, Sir John wholly avoided all controversial and speculative subjects and theories, and confined himself entirely to a lengthened review of Engineering Science (of which he is one of the greatest living ornaments), in its broadest aspect, from the early ages of the world to the present time. No attempt was even made to foreshadow the future triumphs of engineering skill, the past and present only being dealt with. Telegraphy naturally came in for a share of the President's remarks, but little was added to the chronology of this branch of engineering beyond what had previously appeared in the address of the President of the Society of Telegraph Engineers. The following statistics given by Sir John may, however, here be quoted. "The first useful telegraph was constructed upon the Blackwall Railway in 1838, Messrs. Wheatstone's and Cooke's instruments being employed. From that time to this the progress of the electric telegraph has been so rapid, that at the present time, including land lines and submarine cables, there are in use in different parts of the world not less than 400,000 miles of telegraph . . . . . The telegraphic system of the world comprises almost a complete girdle round the earth; and it is probable the missing link will be supplied by a cable between San Francisco in California and Yokohama in Japan. How resolute and courageous those engaged in submarine telegraphy have been will

appear from the fact that, though we have now 50,000 miles of cable in use to get this result, nearly 70,000 miles were constructed and laid."

On the following day the sectional meetings were opened by the Presidents of Sections delivering their addresses, and then commenced the labours of this extraordinary body, which travels over such an immense range of subjects, that, like the elephant's trunk, which with the same ease picks up a pin or tears down an oak, it is equally prepared to discuss the construction of the channel tunnel, or the use of "lady-helps," to trace back the origin of man to the first form of life, or to consider the construction of a new sewer trap.

It may not be inappropriate here, for the information of those who are unacquainted with the working of the association, to state that it was founded in 1831, by Sir David Brewster, who in that year arranged a meeting of the leading scientific men of the day, to be held at York. Here papers were read, models were exhibited, and other steps taken for the permanent advancement of science in the kingdom. Three years later the system of establishing committees, with special grants of money, for the investigation of definite questions was started, and this has been followed up most successfully in succeeding years, questions of importance in all branches of science being dealt with. Telegraphists especially have great reason to be thankful to the British Association, for the labours of that committee which reported on and defined the units of electrical measurement, which have now with such advantage been wholly adopted in this country.

For convenience of working, the meetings are divided into six sections, viz., Mathematical and Physical Science, Chemical Science, Geology, Biology, Geography, Economic Science, and Mechanical Science, and papers on each of these subjects are read and discussed during the meetings.

Comparatively few on electrical or telegraphic subjects have been contributed this year, and none of these would bear satisfactory condensation here. The address of Professor Balfour Stewart, the President of the Mathematical and Physical Section, however, contains the following remarks, which will be read with interest:—

"We are aware that the earth is a magnet. Let us not now concern ourselves about the origin of its magnetism, but rather let us take it as it is. We must next bear in mind that rarefied air is a good conductor of electricity; indeed, according to recent experiments, an extremly good conductor. The return trades that pass above from the hotter equatorial regions to the poles of cold, consisting of moist rarefied air, are therefore to be regarded in the light of good conductors crossing lines of magnetic force; we may therefore expect them to be the vehicle of electric currents. Such electric currents will of course react on the magnetism of the earth. Now, since the velocity of these upper currents has a daily variation, their influence as exhibited at any place upon the magnetism of the earth may be expected to have a daily variation also. The question thus arises. Have we possibly here a cause which may account for the well-known daily magnetic variation? Are the peculiarities of this variation such as to correspond to those which might be expected to belong to such electric currents? I think it may be said that as far as we can judge there is a likeness of this kind between the two peculiarities of these two things, but a more prolonged scrutiny will of course be essential before we can be absolutely certain that such currents are fitted to produce the daily variations of the earth's magnetism. Besides the daily and yearly periodic changes in these upper convection currents, we should also expect occasional and abrupt changes forming the counterparts of those disturbances in the lower strata with which we are familiar. And these may be expected in like manner to produce non-periodic occasional disturbances of the magnetism of the earth. Now it is well known that such disturbances do occur, and further that they are most frequent in those years when cyclones are most frequent, that is to say in years of maximum sunspots. In one word, it appears to be a tenable hypothesis to attribute at least the most prominent magnetic changes to atmospheric motions taking place in the upper regions of the atmosphere where each moving stratum of air becomes a conductor moving across lines of magnetic force; and it was Sir Wm. Thomson, I believe, who first suggested that the motion of conductors across the lines of the earth's magnetic force must be taken into account in any attempted explanation of terrestrial magnetism. It thus seems possible that the excessive magnetic disturbances which take place in years of maximum sunspots may not be directly caused by any solar action, but may rather be due to the excessive meteorological disturbances which are likewise characteristic of such years. On the other hand, that magnetic and meteorological influence which Mr. Broun has found to be connected with the sun's rotation points to some unknown direct effect produced by our luminary, even if we imagine that the magnetic part of it is caused by the meterological."

In addition to the general work of the meeting three special lectures were given. These were, by Mr. Spottiswoode, on the "Colours of Polarized Light"; by Dr. Carpenter, on "A Piece of Limestone"; and by Mr. Bramwell, on "Safety Appliances for Railways." In the latter the lecturer dwelt at length in a very able manner on all the mechanical improvements which have within the last few years been introduced in railway working, and he gave satisfactory and conclusive figures showing the beneficial effect of these, but curiously enough whilst dwelling on the necessity for the block sytem of working heavy traffic, which really compelled the adoption of most of these improvements, he omitted all mention of those numerous electrical appliances, without which the block system in itself could not be carried out for any but the shortest sections.

Two soirees were given during the meeting, the first being wholly devoted to microscopy, the second to general subjects. A large display of telegraphic apparatus was made by the Post Office on the second evening, automatic, duplex, ink writing, sounders and needle instruments, being in direct communication with Manchester, London, Exeter, and Paris, in addition to local circuits across the room. The earliest practical instrument, the five-wire needle, used between London and Slough, and the latest invention, the electro-motograph, were likewise exhibited, side by side. Telegraphic apparatus appears to afford an un-

ceasing subject of interest, on all occasions, when freely exhibited and explained to the general public; even savants who are thoroughly acquainted with all theoretical details, will crowd around to examine the practical working. A constant stream of communications was maintained the whole evening, especially with Paris, from which place information of all kinds was in constant demand. Amongst other matters, as a tribute to an Englishman's pluck, the reply was received in answer to a question as to what was thought of Captain Webb, that he was "*un homme de fer.*"

A magnificent display of vacuum tubes was exhibited by Mr. F. J. Fry, of Bristol, a gentleman who has, perhaps, the largest display of these splendid philosophical toys in the kingdom. Clamond's new thermopile was likewise exhibited in full action, working a small induction coil. This instrument, which has been fully described in this journal, is the most satisfactory solution that has yet been offered of the problem of converting heat directly into electricity in a practical form.

The work of the meeting was finally closed on Wednesday, the 2nd inst., by the holding of a General Committee, when, amongst other matters, grants of money were made for the continued investigation of "Thermo-electricity," and for "Testing the exactness of Ohm's laws."

ON A SYSTEM OF TELEGRAPHY.

A Course of Lectures, delivered at the School of Military Engineering, Chatham,

By W. H. PREECE, Member Inst. C.E., &c.

Lecture I.—A System of Telegraphy as applied to Railway Purposes.

(Continued from page 195.)

One of the most recent improvements, the latest finishing touch, has been to make these signals both by day and by night repeat themselves back to the man who manipulates them, so that the distance and situation of the signal post are to him no longer a matter of consequence. It may be three-quarters of a mile away around a curve hidden by a wood or fixed the other side of a tunnel; indeed, wherever it may be, this faithful tell-tale informs him of its condition.

The line from Southampton to Dorchester was opened in 1847. It was a single line. Trains upon it were also very few, but though few, it almost invariably happened, through the length of the line, that two trains running in opposite directions were on different points of the line at the same time. These trains must necessarily have met and passed each other somewhere. To make them meet and cross without colliding was the first problem to be solved. Meeting stations were appointed where trains were timed to arrive at the same time, and where the first train that arrived had to wait till the second one came. It frequently occurred that the one train was delayed from breaks-down, excessive traffic, and various other causes. The officials at the meeting places were utterly ignorant of the cause—delays became excessive—hence arose one of the first practical requirements for the telegraph. Information was wanted of the position and progress of the trains. A double needle telegraph, similar to that which had been already erected for governmental, experimental, and commercial purposes, between London and Gosport in 1844, was now erected on the Southampton and Dorchester line purely for expediting railway travelling. Intimation of the position of every train was telegraphed from station to station. Three wires were erected, two of which were used for a double needle telegraph with an instrument fixed at each station. To the third wire a bell was attached at each instrument to call attention when needed, but the bell speedily proved a nuisance, for when any one station was required every bell throughout the line was rung, and it was abandoned. A superintendent was constantly travelling up and down the line. When he found by telegraph that one train was late, he would give orders to stop it at a preceding station and take on the other train himself. It was afterwards found that he could best control the traffic from one fixed station in the centre of the line, and change the meeting places of trains from his own office. A very long length of single line was opened in 1860 from Basingstoke to Exeter. The system of the Dorchester Line was too crude. It was much elaborated and improved, and I attach as an appendix to this lecture the full rules and regulations on the subject; the principle however was the same. Superintendents were appointed over separate sections of the line, one from Basingstoke to Salisbury, another from Salisbury to Yeovil, a third from Yeovil to Exeter. Each of these superintendents was informed by telegraph of the movements of every train. When he found they were running irregularly, he would stop one train, move on another, change their meeting places, and so adjust the movements of the traffic that the regularity with which the trains were moved was surprising; the traffic however became too heavy and important for a single line, and the line was eventually doubled throughout. The direct Portsmouth line from Guildford to Portsmouth which was opened in 1859, and the North Devon Line from Exeter to Bideford, which passed into the South Western system in 1862, are still single lines, and the traffic upon them is regulated upon this method. Even on a double line, single line working at times becomes necessary when accidents occur, as for instance, a train may break down and block up one road. A portion of the road itself may be rendered impassable by some accident, or it may be destroyed by an enemy, and only one road may be got ready. A well organized system of working, aided by the telegraph, can then transport the maximum traffic with the minimum danger.

It is in fact the only method which admits of the transference of irregular and large traffic upon a railway of a single set of rails. Additional means for securing safety such as the staff or the block system may be added, but the adjustment of the traffic can only be effected by the telegraph, and the telegraph therefore is an essential feature of a railway.

The staff is a truncheon or ticket, which is attached to each section of a railway, and without which no engine must move, so that between A and B no train or engine can stir without its staff.

When, however, more than one train is required

to run in the same direction the first train carries a ticket only, the last train always taking the staff. the ticket and staff belonging to each other, and the ticket not being used without the staff being seen by the driver. Hence collision is impossible if this system be rigidly carried out, but delays arising from its use are frequenlly excessive, and I have known cases where a man and horse have been sent to fetch a staff to take on a train. Indeed the train staff is wholly inapplicable to any railway upon which the traffic is large.

The block system arose out of the multiplication of trains and the necessity for increased speed. Necessity, the mother of invention, brought it into existence. The block system is that system by which trains are kept apart upon the same line of rails by a certain and invariable interval of *space*, instead of by an uncertain and variable interval of *time*. The term Block is an unfortunate selection. It was introduced through the practice of "blocking" or pinning the telegraph needle over in the earliest instruments used to work the system. The "space" system in opposition to that of "time" would have been more accurate; but the word "block" has now become so thoroughly rooted in railway language that it would be difficult to supplant it.

The practice under the time system is to exhibit the danger signal for five minutes, and the caution signal for five minutes more, after a train or engine has been despatched from or passed any station, junction, level crossing, or siding. Trains are thus said to be kept apart by fixed periods of five minutes, and if the caution signals were properly regarded, by an interval of time even longer than that. The safety of the train is entirely the responsibility of the driver. Immunity from accident is dependent upon his keeping a clear look out. If engines ran at regular and fixed speeds, if time tables could be adhered to, if the line be not crowded with traffic, if the driver could always ensure a good view before him, if signals were near together and they were properly regarded, then a rigid interval of time might be maintained between following trains; but none of these elements of safety are constant. Fast expresses follow slow goods trains, now through a thick fog, now up a wet incline, at one moment in bright sunshine, at the next in a thick snowstorm, creeping mineral trains break down in a long interval between two stations, passengers rush in at the very last minute, detain the train, and prevent the time tables from being adhered to, trains are so frequent at some places that the five minutes interval cannot be adhered to, obstructions to view arise from curves or cuttings, or from atmospheric causes, long lengths of line are unprotected by any signal at all, and signals themselves are too frequently neglected. Hence, the system is brimful of elements of danger, and the inexorable logic of facts has shown that the time interval is illusory and the system unsafe.

But when trains, however rapidly or slowly they may be running, however much punctuality has been infringed, however crowded with traffic the line may be, are invariably kept apart by an interval of one or two miles, collision between them becomes impossible. This is the *Block system*, which has, very improperly, been divided into two classes—the *absolute* and the *permissive*. The former is the block system proper, the latter is not a "block" system at all, but a system introduced by the London and North Western Railway Company at the suggestion of Mr. Edwin Clark, not to secure the safety of their trains, but to increase the capacity of their line for the transmission of their enormously increasing traffic. It is, doubtless, an improvement on the time system, but it bears little affinity to the block, and should certainly not be included in the same category.

I wish to draw a broad distinction between the block system as an abstract principle, and the means of carrying out that principle. The two are very much confused. We hear of Tyer's, of Walker's, of Spagnoletti's, and of other block systems. They are not block systems; they are simply instruments devised to carry out the electrical portion of the block principle.

The block system can be carried out by any system of telegraphy, nor is it even necessarily an electrical question, but practically it must become so, and any form of instrument which may be in use upon the railway can be converted into a means to work the system.

[The lecturer then exhibited the form of instrument employed in carrying out the block system upon the London and South Western Railway.]

The block system on single lines is additionally used to protect trains from *advancing* as well as from *succeeding* trains. Before a train is allowed to leave A the line at B is blocked in advance, and when it leaves it is blocked behind at A, so that it is thoroughly protected in both directions during the period it is running from A to B.

But apart from the protection which electricity imparts to railway travelling and the facility it offers for adjusting and regulating the traffic, there are innumerable purposes for which the telegraph is employed to facilitate business and to secure efficiency. The distribution of correct time, the collection of spare trucks and coaches, the relief of staff, the supply of assistance in cases of accident and danger, and—not least—the reparation of the error and thoughtlessness of passengers. In examining the messages at railway stations, an inquiry for the inevitable black bag is invariably seen, and I have also seen an inquiry for a pair of spectacles and a pig, an umbrella and the Bible, a purse and a barrel of oysters, a great coat and a baby.

But to return to our own immediate subject which must occupy the prime attention of the Commander, viz:—the employment of Railways in the time of war for the movement of troops, of the materials of war, of stores and of food; an inseparable and fundamental part of the organization of this service is the proper control regulation and management of the telegraph. It is not too much to say that the success of future operations of war will depend upon the rapidity with which trains are moved and upon the efficiency with which railway service is managed, and these are essentially the functions of the telegraph.

Catastrophes must, and will happen, but the element of accident pure and simple plays a very small part in railway catastrophes. The so called "accidents" are generally the result of carelessness of servants, economy in management, imperfect discipline, neglect of regulations or want of organization. I have endeavoured to sketch out to you what should be the organization of that portion of

railway working dependent upon a system of telegraphy; I give you a copy of the latest and most carefully corrected regulations for working double and single lines; discipline and management rest with yourselves, but where human agency exists we must be always liable to human error, and it is hopeless to expect that soldiers are more exempt from human frailties than those much abused railway servants who are employed in the regulation of the traffic upon our railway system.

I cannot conclude without paying a tribute of respect to those officers of the Royal Engineers who act as Inspecting Officers of the English railways to the Board of Trade. The reports of these officers upon accidents which occur are not only interesting as narratives, but instructive as to the different modes of working on different lines. They are the records of past experience. They favour the application of the law of average to bring out the defects or merits of variations in railway working. Dangerous modes of working are frequently carried on for long periods without accident, but inevitably they break down at last. The Board of Trade publishes these accidents, and brings to the knowledge of the many what would otherwise have been the experience of only the few. The lessons taught by experience are thus promulgated, discussion is invited, and the process of pure scientific reasoning applied. These reports of officers of the Royal Engineers furnish experimental data to form the basis of a true science—the science of railway working. If anyone desires to learn how to work a railway let him read these reports, if he wants to know how to construct and maintain a telegraph, let him read the lectures that have been delivered before, and the professional papers that have been published by the Corps. If he wants to know how to combine the two I trust I have sketched lightly, but I hope comprehensibly a system which has the merit of being created by that best of teachers—superior to all the theory of the universe—stern experience.

(To be continued.)

ELECTRICAL SCIENCE IN CHINA.

LAST year, during the height of the excitement caused by the anticipations of war with Japan, the Imperial authorities gave directions to establish a college for the instruction of a staff of Chinese in the science of torpedo engineering.

An extensive building has been secured near the City of Foochow, admirably situated on the River Min; about forty students got together, and a large supply of the latest and most improved torpedo apparatus, manufactured by the Silvertown Telegraph Company, sent out. Some of the instruments are most beautiful specimens of the application of electrical science to modern submarine warfare; indeed the whole of the plant is identical with that at present used by our Royal Engineers at Chatham and elsewhere. The services of Mr. J. A. Betts, M.S.T.E., have been secured as Engineer-in-Chief. Mr. Betts was formerly in the torpedo department of the Silvertown Telegraph Company, and left England in October last.

The course of instruction will include the manufacture of torpedoes, mooring and placing them in position, the use of the "firing arcs" in torpedoes fired by observation, lime-light signalling, &c. A class will also be formed to receive instruction in practical telegraphy, testing, &c.

Active operations are being carried on at the arsenal, inside the city, for the manufacture of the mechanical parts necessary for the completion of a large stock of torpedoes; the electrical stores will of course be supplied from England.

What with the satisfactory arrangement of the dispute between the Chinese Government and the Great Northern Telegraph Company, concerning the Foochow-Amoy telegraph line (in which Mr. Betts acted as arbitrator for the Chinese Government), and the formation of a corps of Torpedo Engineers, China would seem to be advancing, whether for good or evil to foreign interests remains to be seen.

Notes.

EXPERIMENTS with the electric light as a head light for locomotives have recently been made in Russia on the railroad from Moscow to Kursk with successful results. The apparatus consisted in a battery of 48 couples, which produced sufficient illumination to light up the track for a distance of from 1,500 feet to 1,800 feet ahead. A correspondent of *Les Mondes* suggests that a small electric machine would serve the purpose much better than a galvanic battery.

Telegraphic communication has been opened with Gladstone, in the northern agricultural districts of South Australia.

The number of telegrams despatched by the Great Northern Telegraph Company in the first seven months of this year, was 414,648, as compared with 458,134 in the corresponding period o 1874, showing a decrease this year of 43,486 telegrams. The revenue collected by the Company to July 31, this year, was £96,394, as compared with £99,469 in the corresponding period of 1874, showing a decrease of £3,075 this year.

Mr. George Robinson has patented a new process for sawing wood. The process, consists in substituting a platinum wire for the saw. The wire is heated to a white heat by the passage of an electric current. The wire, to which a forward and backward movement is given, cuts across the hardest woods with inconceivable ease. The platinum wire, constantly maintained at a white heat by the electric current, advances in the wood by carbonizing the surface which it touches, but this carbonization is entirely superficial and has no bad effect.

The directors of the Indo-European Telegraph Company, at their board meeting on the 7th instant, declared an interim dividend for the six

months ended 30th June last, at the rate of 5 per cent. per annum.

The S.S. *Caroline* has left for Whitehaven with the Isle of Man cable on board, and the restoration of communication may be expected at any moment. The cable is almost entirely new and of a heavier type than the former. It is to be hoped that it will be some years before there is any interruption again.

The Great Northern Telegraph Company's traffic receipts for the month of August amounted to 385,001 francs, as against 415,383 francs in the corresponding period of last year. The total traffic receipts from 1st January to 31st August amounted to 2,794,859 francs, as against 2,902,109 francs in the corresponding period of last year.

The Eastern Telegraph Company's traffic receipts for the month of August amounted to £30,005, against £31,265 in the corresponding period of 1874. The traffic receipts of the Eastern Extension, Australasia, and China Telegraph Company (Limited) for the same period amounted to £20 072, against £19,627 for the corresponding period of 1874; and those of the Brazilian Submarine Telegraph Company (Limited) to £10,032, against £9,761 last year.

The number of messages passing over the Cuba Submarine Telegraph Company's lines during the month of August was 2,272, estimated to produce £2,200, against 1,750 messages, producing £1,622, in the corresponding month of last year.

Information has been received by the Cuba Submarine Telegraph Company of the interruption of the Key West Punta Rassa cable belonging to the International Ocean Telegraph Company. Communication between those points is being maintained by steamer at a delay of about one day. Should the cable not be speedily repaired the new cable, which has arrived out but is waiting for more favourable weather, will be at once laid.

An official announcement has at length been made of the completion of the repairs of the Direct United States Cable. The insulation of the cable is reported by the contractors as being perfect:—"We understand that the tariff of the Direct United States Cable Company, whose cable, as announced, is finally in complete working order, and which will be opened for traffic on the 15th inst., has been settled as follows:—To Canada, by day, 1s. 10d.; by night, 1s. per word; to New York and the zone comprising New England and Pennsylvania, by day, 2s.; and by night, 1s. 2d.—the rates for the other zones into which the working on the American continent is divided being calculated on the same basis. The peculiarity of this tariff, it will be seen, is the distinction between day and night service, which is in reality a distinction between express and non-express messages, the former being charged a higher rate. The non-express messages, however, are not to be subject to any delay. The arrangement simply is that any person may put in a telegram at any hour of the day, marked *night* service, and it will be delivered next morning. As practically two-thirds of the messages transmitted are believed only to require delivery next morning, the tariff now established is for general purposes only 1s. 2d. a word, and fairly enough a higher charge is made where delivery before next morning is important. The reform of charging specially for express messages has often been urged upon telegraph companies, and the new competitor for Atlantic telegraph business does good service by introducing it, in addition to the benefit it confers on the public directly by lowering its general tariff. The Direct Company is thus fulfilling its pledges to make messages cheap, the public being also virtually indebted to it for having already, by the mere prospect of its competition, compelled the lowering of former high tariffs to the present rate of 2s. per word. We may express the hope that the policy thus initiated will be faithfully adhered to."—*Daily News.*

Not so many years ago it was considered a feat in deep-sea sounding to reach a mile or a mile and a half, and even then, after allowance has been made for the action of currents upon the line, the actual depth attained was a good deal matter of calculation or guess. Breakages also were continually occurring in the hauling up, from the necessary slenderness of the cord in comparison with the weight of the lead. The modern method by which the lead detaches itself at the bottom meets that as well as several other difficulties nearly as important, and the wonder is that it was not thought of sooner. Now there is scarcely any limit to the depth of soundings, except the depth of the sea, which the recent explorations of the Challenger go far to show to be in accordance with the theory that its greatest depth is equivalent to the height of the highest elevations above its level. The deepest sea soundings yet effected were obtained by the Challenger this year in the abysses off New Guinea, depths which have occasioned a sharp line of demarcation between the fauna of Asia and Australasia. The "lead" weighed 4 cwt., and struck bottom at the tremendous depth of 4,450 fathoms, or about 26,700 feet. The hollow rod, by which specimens of the bottom are brought up, was full of mud, and both the thermometers that had been sent down were smashed to atoms by the

enormous pressure of the superincumbent water. A previous unsuccessful attempt to reach the bottom, but in which 4,545 fathoms were sounded, showed the temperature at that depth to be 35½ deg. Fahr., uncorrected.

The traffic receipts of the Direct Spanish Telegraph Company for the month of August were £1,773, against £1,282 in the corresponding period of last year. From the same company we learn the average time occupied in the transmission of telegrams between Madrid and England, "*via* Santander," during August was three hours and four minutes (including transmission over Spanish land lines).

The half-yearly meeting of the proprietors of the Submarine Telegraph Company was held on August 24th, at the London Tavern, Bishopsgate-street, Sir James Carmichael in the chair. The report and accounts having been taken as read, the Chairman, in moving their adoption, said there was very little to which he need call the attention of the meeting. They were all aware of the Telegraphic Conference which had been held lately at St. Petersburg, and at which that company was efficiently represented by its secretary, Mr. Clare. He was happy to say that nothing occurred there which affected the interests of that company. Various resolutions were passed respecting international traffic, but none of them affected their interests. The delegates considered it not desirable to alter the rates for the general European traffic, and therefore they remained in *statu quo*. So far as his own opinion was concerned, he would have been glad to have seen a moderate general reduction of the rates, believing that such a reduction, if made prudently, always led to an increase of traffic, and encouraged the public to telegraph more than they had done; but, as he had first mentioned, the delegates of the different governments thought otherwise. He regretted that the receipts of the last half-year were not a little larger, but it must be remembered that that was always the worst half year. So long as there was no speculative action on the Continental Bourses they could not expect any great increase of telegrams; but he was happy to say that the tide was turning, and they had never done a better business than during the last fortnight. (Hear, hear.) The expenses were a little higher than in the corresponding half of last year, but that was to be accounted for by the increased number of Hughes's instruments employed. There were now six of these working at Paris; and they used them whenever they had an opportunity, because, although they were more expensive than other instruments to purchase, and required an extra clerk to work them, the advantages in speed and accuracy fully compensated the company for the additional outlay. He was happy to say that the debenture debt of that company had been completely extinguished. (Hear, hear.) That company now stood in a position which was occupied by few companies connected with the City of London, that of having neither debenture debt nor preference stock, so that all the earnings went to the shareholders. (Hear, hear.) The cables were in excellent working order, and at that moment there was not a single sick cable. Of course that was in a great degree owing to the large sum which had been spent during the last year on renewals. That money had been well spent. Their steamer had been lying in the Granville Dock for the last eight weeks without going to sea, and the fact that when an accident occurred a few week ago the cable affected was repaired within two days, showed of what immense importance it was to have a steamer always ready for use. In conclusion, he congratulated the meeting on the condition and prospects of the company, which were never more sound and encouraging. (Cheers.) The motion was then agreed to, after which a dividend at the rate of 15½ per cent. per annum was declared. The retiring directors and auditors were then re-elected, and on the motion of Mr. Boys, a vote of thanks was given to the directors.

Prof. Palmieri has discovered a new instrument which he calls a "diagometer," and which is constructed for the rapid examination of oils and textures by means of electricity. What the apparatus will do, Prof. Palmieri details thus:—1. It will show the quality of olive oil. 2. It will distinguish olive oil from seed oil. 3. It will indicate whether olive oil, although of the best appearance, has been mixed with seed oil. 4. It will show the quality of seed oils. 5. Finally, it will indicate the presence of cotton in silken or woollen textures. The professor has been complimented for this invention by the Chamber of Arts and Commerce at Naples, who have published a full description of the apparatus, with instructions for use.—From *Nature*.

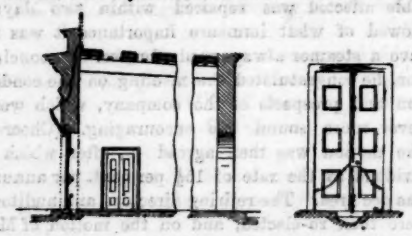
Correspondence.

To the Editor of the TELEGRAPHIC JOURNAL.

SIR,—On the night of May 31st, during a thunderstorm, the lightning struck the Brazilian Vice-Consul's house. The house, like most houses here, is nearly flat-roofed, with bricks laid on strong hard-wood battens and joists, and covered with flat, square tiles, laid in cement. On the roof over the door there was a flag-staff 18 feet long, and about 4 inches diameter at the lower end, and fastened to the parapet-wall of roof with iron staples. This was struck and shattered longitudinally into several

pieces, many of them not thicker than a lucifer match. One of the larger pieces, 10 feet long and 2 inches broad, was thrown on the roof of a house on the opposite side of the street, about 50 yards away. There were two holes made in the roof about 2 feet square—the first about a yard from the heel of the flag-staff, and the other 2½ yards from it, nearly in a straight line. The plaster on the front wall facing the street was cracked, and there was a small opening made diagonally from the staple that held the heel of the flag-staff through the wall down to an iron shield with coat of arms painted on it, that hung over the door; and where the lower part of this shield was fastened to the door-frame, the lightning seems to have passed through the frame, splitting and charring the wood, as if a red-hot iron had been passed through it, to a vertical iron bolt on the inside used for fastening the door. From the end of this bolt it ran along the wood-work, blackening it in its passage to the lock 3 feet from it. At the lock it divided itself into 3 parts—one running to a hinge on each side of the door, and from the hinges to the ground; the other part to a bolt at the foot of the door, and from thence to the earth, tearing up about 18 inches of the tiles on the floor.

A man and boy in the next room were thrown down,



The paint on the shield, bolts, hinges, and lock, were not in the least discoloured, but the lead-coloured paint on the door was blackened, showing where the lightning passed from one part of the iron to the other.

In the hole made in the roof the bricks and tiles were knocked away, but the wooden battens and joists remained intact. There were no pieces of metal in the roof, save the nails that fastened the battens to the joists.

It is easy enough to account for the pieces of the flag-staff being thrown to a distance, by the lightning decomposing the moisture in the pores of the wood, and the gas thus formed expanding, tearing, and scattering the fragments to a distance.

The holes in the roof might be accounted for in the same manner, by supposing that there were slight cracks in the tiles, and that these were filled with water, as it was raining at the time, and when the lightning ran along the wet roof it decomposed the water in these cracks, bursting holes in the roof and escaping over the wet surface of roof and wall in rear to earth. But I would like to know the opinion of some physicist on the subject, and if he can offer any other explanation. Perhaps you or some of your readers could oblige me. I enclose a sketch of the door, and a section of the roof and walls as they appeared the morning after the stroke.

I am, yours sincerely,
J. H. Bloomfield, F.A.R.

Concordia Republica Argentina.
4th July, 1875.

Notices of Books.

The Equatorial Needle, or a Compass which swings E. and W. &c. By W. A. Ross. London: E. & F. N. Spon.

The author informs us that these remarks were thrown hastily together, and are not to be considered as having been thoroughly digested. We quite agree with him. He has much to learn, especially of magnetism.

Explanation of the Double Balance Method of Duplex Telegraphy. By W. P. Johnston, Indian Government Telegraphs, Calcutta.

This is a pamphlet printed for private circulation, and is very ably put together. It describes the system of duplex telegraphy introduced into India by Mr. Schwendler, which is, in fact, Mr. Stearn's bridge method considerably overloaded with unnecessary resistances; so much so that "about four times the battery power employed for single working is required." It is said that the "*double balance*" has been adopted to avoid the objection that "in all the other known duplex methods, balancing the outgoing current at one station disturbs invariably the balance at the other station, and therefore if balance in any one station has once been disturbed, it can be regained only by successive adjustments in both stations." This is one of those among many objections which sanguine inventors, in describing their inventions, are so fond of indulging in, but we are surprised that such practical telegraphists as Messrs. Schwendler and Johnston should give currency to such a myth:

GATHERINGS FROM THE EDITOR'S NOTE BOOK.

When a cable is perfect, the tests of positive and negative currents are similar; when any flaw exists they vary.—(Thomson).

Christie invented Wheatstone's parallelogram in 1836, and it is described in the *Philosophical Transactions* for that year; and J. B. Cooke, proposed the shunt in 1847, which is also described in the *Philosophical Transactions* for that year.

The Messrs. Siemens first established the present careful system of testing cables upon the Malta and Alexandria cable in 1860, and were thus the means of introducing the Wheatstone bridge into general use.

Mr. C. F. Varley pointed out as early as 1856 that it was better to use zinc currents when testing a line for earth. The copper currents decomposed the water in the fault, and caused it apparently to disappear by coating the wire with oxide. The zinc current remedied this defect.

A contact between two wires, due to a bad earth at the terminal station, is easily determined by watching the direction of the currents. If the direction of the currents be the same at each station, it is bad earth; if different, it is on line.

One of the earliest and prettiest experiments, to show the repulsion due to similarly charged bodies, was devised and practised by Cavallo. He applied a feather to an electrified glass tube. The feather at first sticks to the glass; it becomes slowly charged, and then flies off. It is then easily maintained floating gracefully in the air, the same side being always presented to the tube. With an excited glass tube and an excited ebonite rod, the feather can be made to fly from one to the other like a shuttlecock. Faraday was very skilful in maintaining a gold leaf floating in the theatre of the Royal Institution, and Tyndall sometimes repeats the experiment.